WERA1007 - Curly Top virus Biology, Transmission, Ecology, and Management

Annual Meeting Dates: 07/18 - 7/19/2016

Annual Report Date 07/25/2016

**Participants:**

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Plant Pathology and Weed Science

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Jennifer Willems (Jennifer.willems@cdfa.ca.gov) - California Dept of Food and Ag/BCTV

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Carl Strausbaugh (carl.strausbaugh@ars.usda.gov) - USDA-ARS, Kimberly, ID

Quaid Dobey (quad09@nmsu.edu) - New Mexico State University, Entomology, Plant

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Mike Green – Wyoming Sugar Company, Worland, WY (307- 347-9801)

Greg Dean – (gdean@amalsugar.com) Amalgamated Sugar Co, Idaho-TASCO, Boise, ID

Oliver Neher (oneher@amalsugar.com) - Amalgamated Sugar Co, Idaho-TASCO, Boise, ID

Brian Schutte (bschutte@nmsu.edu) - New Mexico State University, Entomology,

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Myron Casdorph – (mcasdorph@wyosugar.com) Wyoming Sugar Company, Worland, WY

**Summary of Meeting Minutes**:

 Oliver Neher welcomed the group to the Wyoming Sugar office. Rebecca Creamer explained a bit about the group and its purpose. Introductions were made, and the agenda was discussed.

 Rebecca Creamer presented background information on curly top and the beet leafhopper with an emphasis on the situation in New Mexico. Chile is the most economically important crop host for the virus in New Mexico. The worst curly top years for the state were 2001, 2003, and 2005, however curly top damage is generally localized and can occur any year. The most common weed hosts for the beet leafhopper are London rocket, which serves as an overwintering host, and Kochia, which serves as an oversummering host. She discussed her efforts to develop disease prediction models based on the two weeds hosts, and had success with using London rocket growth related to environmental parameters to predict the magnitude of spring beet hopper flights.

 Allen Poplawsky reported on curly top in southern Idaho from Alex Karasev’s laboratory in which previous work demonstrated mild curly top, Logan and CFH strains on sugarbeets. He discussed at length testing of beet leafhoppers from the Columbia Basin of Oregon collected 2007-2009. The beet leafhoppers were removed from sticky traps collected April-November and extracted and tested by PCR. The percentage virus found was 14% in 2007, 25% in 2008, and 17.4% in 2009, for an average virus presence of 18.9%. The highest levels of virus were found in June, followed by August. Only the Worland strain of BCTV was found in 2007 and 2009. After sequencing, the strain found in 2008 was determined to be a Wor/CFH recombinant similar to CO-95, but with slightly different recombination sites.

 Tesneem Nusayr reported on her experiments that show that beet leafhopper endosymbionts produce GroEl that differ from other GroEL from other hoppers. She showed through bacterial 2-hybrid and beta galactosidase production that the beet leafhopper GroEL binds to the curly top capsid protein, but not stronger or more specific than does GroEL produced by *E. coli*. There was discussion and interest from the group about the possibility of using this with a transgenic approach to block transmission.

Quaid Dobey talked about his research, carried out in conjunction with Brian Schutte and Rebecca Creamer, looking at the temperature requirements for Kochia germination from southern New Mexico. He found increased Kochia germination associated with a variable temperature regime of lower temperatures that was then transferred to higher temperatures, than when retained at the lower temperatures. He is also studying feeding preference of the leafhopper on different sizes of Kochia to determine why the leafhoppers move off of Kochia onto chile, which is a non-preferred host.

Carl Strausbaugh reported on sequencing of curly top isolates collected as part of a 2006-2007 survey of infection of curly top in sugarbeets. He redid the survey in 2012-2015 and characterized those strains. Overall he found 10 BCTV strains based on whole genome sequencing: SvrPep (NM), Kim1, LH71, Mild, Wor, CO, Cal/Logan, Svr(CFH), PeCT, SpCT, and PeYD. The Mild, Worland, CO, LH71, and Kim1 group together in the middle of the phylogram but in different clades. In 2006, 82% of the samples were infected with Svr (CFH), 100% with Worland-like strains (mainly CO and Wor), and 14% with Cal/Logan. In 2013, there was 8% Svr, 76% Cal/Logan, and 78% Worland. In 2014 and 2015 almost all (95-96%) samples were infected with Worland-like strains and very few (0-2%) with Svr (CFH). Thus the proportion of strains changed over time. Further analysis of the sequence revealed isoaltes fell into three primary groups which contained further subdivisions: Worland (06/07 and 12-15 subgroups), Svr (ID/OR and MT/WY subgroups), CO (CA, ID/OR, and CO/NE subgroups).

 Jennifer Willems gave an update on the curly top problem in California and the control board management efforts. For updates on BCTV control in California, subscribe to BCTV at <http://www.cdfa.ca.gov/subscriptions/>. 2013 was a very bad BCTV year for the Central Valley of California. 2016 turned out to be a much lighter year. There was no fall spray campaign in 2015. Sprays were done in late March 2016, but rain in April caused further germination of plantago and filaree. BCTV was at less than 2% statewide in 2016. However, organic tomatoes continue to be infected at a higher rate. Summer weed hosts of the beet leafhopper are Russian thistle, Bassia, goosefoot pigweed, while winter hosts are Filaree, peppergrass and plantago. Kaolin clay sprays were attempted for leafhopper control, but gave mixed results. It appears that the beet leafhoppers are staying through the winter in the valley instead of all migrating back to the foothills. Growers are now using sticky traps to get personalized results in addition to the regular efforts of the control board to sweep and spray.

 Lauren Murphy reported on control board experiments using organic pesticides to control the beet leafhopper in California. Three organic insecticies: Azera, Ecotek, and Tritek, were compared with malathion sprays, all at label rates applied using a ground rig. The tests were done treating Bassia hyssopifolia. The test was run in the fall. Pretreatment there were 7-15 beet leafhoppers/10sweeps. Results were tested at 72 hrs post treatment. Malathion worked substantially better than any of the organic insecticides. However, Ecotec worked the best of those and will be tested again at very high concentrations such as 10 gal/acre.

Greg Dean noted that there has been a natural decrease in beet leafhopper pressure over the last 10-12 years in Idaho. He speculated that other management strategies might have had an influence on the beet leafhoppers. The use of insecticide treatment on the seed combined with the frequent use of Roundup to control weeds likely had a positive effect on reducing beet leafhopper numbers. He speculated that mosquito abatement programs in some areas might also have had a beneficial effect on beet leafhopper numbers.

Myron Casdorph noted many of the same trends for Wyoming and said that 2006 was the last bad curly top year for the area. He noted that flixweed has been the predominant curly top overwintering host for the area.

**Research Questions/Priorities –**

The group discussed the status of the disease, which research topics are important for a particular location and crop, and what our key research priorities would be. The list below is presented in no particular order.

 Prediction model for California, New Mexico

 Quick field test for curly top for growers to use in the field for tomatoes

 Additional management options to use in California in endangered species preserve areas.

 Determine the driving force behind virus strain changes

 Determine where leafhoppers are coming from when they move into the field. What is the scale of that movement? How far are they moving?

 Are there plant resistance genes that can shut down curly top replication?

 Can we target vector transmission aspects to specifically interrupt transmission, perhaps using knowledge of GroEL?

There was a brief discussion as to the location for next year’s meeting. The preferred location was Washington, Tri cities or Prosser, 2nd choice would be Las Cruces, NM

**Tours-**

There were several excellent tours during our half day of meeting.

Wyoming Sugar Processing plant –

Insecticide spray program – Jared Glanz (wcwp@ryconnect.net)

Mixed vegetable farm / CSA – Lloyd Craft Farms

Sugarbeet Field trials – Myron Casdorf

**Meal Sponsors-**

Our meals were all industry sponsored!!

July 18 – lunch – TASCO-ID – Amalgamated Sugar Co.

* dinner – Bayer Crop Science

July 19 – lunch - cookout – Wyoming Sugar

**Group Accomplishments**

Collaborative curly top projects for 2015-16 were carried out among Robert Gilbertson, Jennifer Willems, and Bill Wintermantel,. Cooperative projects were carried out between Carl Strausbaugh, and Bill Wintermantel and between Carl Strausbaugh and Alex Karasev.

**Impact Statement**

The group has made an impact of curly top in the western U.S. The use of predictive systems and management strategies was assessed, the curly top viruses for particular areas were characterized, and the relationship between viruses and specific weed hosts was assessed.

**Publications**

The group did not publish a report together.